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19 August 2004

Your ref.: PCT/NO2004/000012
Our ref.: E34309-JFL

Re:
International Patent Application No. PCT/NO2004/000012
TELENOSTRA AS et al

Dear Sirs.

In connection with the filing of the PCT-DEMAND / Chapter II examination dated 18 August 2004, the applicants herewith file – in accordance with PCT-article 34 – an amended set of claims, to replace the originally filed claims. The amended claims are to be used as basis for a first PCT/IPEA/SE Written Opinion.

Filing of Amended Claims - Cross-reference table

Amended claim	Basis for new claim
1	Preamble takes into consideration reference D3, and is otherwise based on original claim 1, 3, 8, 12
2	Original claim 2 and specification
3	Original Claim 8
4	Original claim 4
5	Original claim 5
6	Original claim 6 (the claims has got a cosmetic amendment for clarity reasons)
7	Original claim 7
8	Original claim 9
9	Original claim 10
10	Original claim 11
11	Original claim 13
12	Original claim 14
13	Original claim 15 and figs. 5 and 9 with related disclosure
14	Figures 5 and 9 with related disclosure
15	Original claim 16 (some cosmetic amendments to clarify meaning)
16	Original claim 18 (amplifying interaction with tilting device arms)
17	Original claim 19
18	Original claim 20 (with first feature deleted)

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Intellectual property rights consultants
Denmark - Norway - Sweden

The amendments as made in the claims are indicated immediately below. A Clean Copy version of the claims is attached.

It is believed that all of the amendments are fully supported by the original description, claims and drawings, and that no new matter in the patent sense has been entered through the amendments. It is therefore respectfully submitted that the amended claims should be entered.

P a t e n t c l a i m s

1.
A multifunctional switch device having [a function for rotation and also] tilt [and/or press] functions, intended for use in electronic equipment such as computers, handheld electronic apparatus and/or devices associated with use in means of transport such as vehicles, boats and aircraft, said equipment having or being connected to a display for function control, [characterised in]

- [that] the switch device [has] having a central tilting device consisting of a housing which surrounds two mutually movable, cardan coupling-supported parts, [wherein] a first of the parts [is] mounted to the housing or to a base part of the device at a first pair of supporting points,

and [wherein] a second of the parts [is] supported on the first part at a second pair of supporting points which are offset 90° relative to the first pair [. (Figs. 1-2)] ,
characterized in
that the switch device has an operating member or element which is stepwise rotatable relative to the housing with means to detect stepwise position of the operating member,
that the operating member is tiltable as well as downward pressable,
that the second part of the tilting device has arms in a cross shape that are configured to actuate underlying switch contact points upon tilting of the operating element,
that the second part has a hole in the centre for slidably receiving a shaft located on the operating member, said member forming a rotatable, tiltable and depressible part of the switch, said shaft operative as an actuator for a centrally underlying switch contact point.

2.
A multifunctional switch device as disclosed in claim 1,
characterised in that the housing, being in the shape of a ring, as well as said first part and said second part are fixedly attached to each other to form a one-piece unit, the supporting points being flexible and torsional for mutual cardan movement.

3.
A multifunctional switch device as disclosed in claim 1,
characterised in
that the first of the two mutually movable, cardan coupling-supported parts is mounted to a switch base at a first pair of supporting points; and that second of said parts is supported on the first part at a second pair of supporting points which are offset 90° relative to the first pair, said first and second parts forming a one-piece unit.

[2.
A multifunctional switch device as disclosed in claim 1, characterised in

- that the housing of the tilting device and said first part and said second part are fixedly attached to each other; and
- that the supporting points are flexible and torsional for mutual cardan movement.]

[3.
A multifunctional switch device as disclosed in claim 1 or 2,
characterised in
- that the second part of the tilting device has arms in a cross shape that are designed to actuate underlying contact points, and that the second part has a hole in the centre in which is arranged a shaft for a rotatable part of the switch and which forms the operating element of the switch device, and actuator for a centrally underlying contact point.]

4.
A multifunctional switch device as disclosed in claim 1, 2 or 3 [or 2],
characterised in
- that the mutually movable parts of the tilting device are made of a flexible material.

5.
A multifunctional switch device as disclosed in claim 1, 2 or 3 [or 2],
characterised in
- that the two mutually movable parts of the tilting device are mounted on supporting points via shafts partly rotatable therein.

6.
A multifunctional switch device as disclosed in [one or more of claims 1-5] anyone of claims 1 - 5,
characterised in
- that a centre portion of the tilting device which forms a mount for the rotatable shaft of [part of the switch device and
mount for an] the operating element has a plurality of vertical faces and/ or grooves, against which at least one spring[s attached to the frame] of the switch device rides [grip] in order to effect stepwise rotation of the operating element. [(Figs. 2c, 3b, 3d)]

7.
A multifunctional switch device as disclosed in claim 6, characterised in
- that the stepwise rotation is detected by means of contact springs which tilt on contact with grooves in the rotary element, and form contact with and/or short
circuit at associated contact points arranged on the frame of the switch device.

[8.
A multifunctional switch device with a function for rotation and also tilt and/or press functions, intended for use in electronic equipment such as computers, handheld electronic apparatus and/or devices which are associated with use in means of transport such as vehicle, boats and aircraft, said equipment having or being connected to a display for function control, characterised in

- that the switch device has a central tilting device which consists of two mutually movable, cardan coupling-supported parts, wherein the first of the parts is mounted to a switch base at a first pair of supporting points; and
- that the second of the parts is supported on the first part at a second pair of supporting points which are offset 90° relative to the first pair,. (Figs. 5-9)]

[9] 8.
A multifunctional switch device as disclosed in anyone of claims [8] 1 - 7, characterised in
- that the first part of the tilting device is fixedly attached to the second part via a second pair of supporting points, wherein the supporting points are flexible and torsional.

[10] 9.
A multifunctional switch device as disclosed in claim 8 [or 9],
characterised in
- that the first part of the tilting device has a pair of projecting tilt pins for pivotal engagement with the first pair of supporting points.

[11] 10.
A multifunctional switch device as disclosed in anyone of claims [8, 9 or 10] 1 - 9,
characterised in
- that the first part of the tilting device has a pair of supporting points which are fixedly attached to the base and a frame, wherein the supporting points are flexible and torsional. [(Fig. 9)]

[12.
A multifunctional switch device as disclosed in one or more of claims 8-11,
characterised in
- that the second part of the tilting device has arms in a cross shape which are arranged to actuate underlying contact points; and
- that the second part has a hole in the centre through which there is provided a shaft for a rotatable part of the switch which forms the operating element of the switch device, and actuator for a centrally located contact point.]

[13] 11.
A multifunctional switch device as disclosed in [one or more of claims 8-12] claim 6,
characterised in
- [that a central midportion of the second part of the tilting device has a plurality of vertical faces; and]
- that [a] spring is fastened to a rotatable [part] operating member of the switch device [which forms an operating element, the spring gripping thereagainst in order to effect stepwise rotation of the rotating part].

[14] 12.
A multifunctional switch as disclosed in claim [13] 11,
characterised in
- that the spring is of the wire type and is in the form of a clip.

[15] 13.
A multifunctional switch device as disclosed in [one or more] anyone of claims [8-13] 1 - 12, characterised in

- that the [switch device has a] rotatable [part] operating member which [forms an operating element and which] is pivotally supported in the tilting device[, and having] has mounted thereon an annular slip ring for sensing against contact fields located on [said base] a frame part of the device for detection of [the] a rotary position of the operating [element] in relation to the base of the device.

14.
A multifunctional switch as disclosed in claim 13,
characterised in
- that said annular slip ring has two diagonally located points for attachment to the operating member and two diagonally located pins for contacting the contact fields.

[16] 15.
A multifunctional switch device as disclosed in one or more of claims [8-13] 1 - 14, characterised in

- that the base of the switch device has a plurality of snap discs and associated plurality of contact fields [for] to provide for [actuating] respective switch functions upon tilting or depression of the operating member; and
- that the base has mounted thereon an outer frame internally of which [has] is located in a ring configuration a plurality of contact fields which contact points on the slip ring touch[es] for [contact and] detection [on rotation of the] of rotary position of the operating member relative to the device base [element].

[17.
A multifunctional switch device as disclosed in one or more of claims 8-13,
characterised in

- that the device has a frame part which contains contact fields for sensing rotation of the operating element. (Fig. 9)]

[18] 16.
A multifunctional switch device as disclosed in anyone of claims 1 - 15 [one or more of claims 8-13], characterised in

- that central depression of the operating [element] member and its shaft part is designed to cause collapse of [the] an[d] underlying snap disc on a central contact field , whilst pressure on an outer part of the operating [element] member or tilting of the operating [element] member is designed to provide a movement of the tilting device which causes, through interaction with one of the arms on the tilting device, a collapse of one of the [underlying] outer snap discs on an associated contact field underlying said arm.

[19] 17.
A multifunctional switch device as disclosed in one or more of claims 1-16,
characterised in

- that the operating [element] member has an outer face, or is encased by a part made having an outer face which is smooth or has contours, dimples or structures for friction against a user's finger in the peripheral area; and

- that the outer face is concave in a central part thereof and with [where] a tactile pin or depression is arranged in the centre. [(Fig. 8)]

[20] 18.
A multifunctional switch device as disclosed in [one or more] anyone of claims 1 – [19] 17, characterised in
- [that the central tilting device forms the basis for switch functions for a switch device consisting of a stepwise rotatable operating element in the form of a disc which is designed on rotation to move a cursor, screen image or other screen- related functions, stepwise in a graphical user interface, and which] that the operating member is centrally depressible, stepwise rotable, as well as tiltable in four directions in order to actuate respective switch functions associated with such available movements of the switch device. [(Fig. 4)]

Discussion of closest prior art (D3)

The applicants consider (D3) US 6,225,579 to be the most relevant of the cited references, whereas (D2) US 6,084,189 and (D1) EP1,182,678 are of lesser relevance. The other cited references (D4) US 5,047,596 and (D5) US 4,103,132 have been carefully considered, but it is respectfully submitted that neither of these are particularly relevant to the technique of the present invention.

The discussion of the prior art is focused on reference D3 which is considered to be the most relevant of the references.

Functional differences:

D3 discloses an operating element (button) 116 with depending legs 108, 110, 112 and 114 for directly and selectively activating four available switch means 148,150, 152, 154.

Telenostra AS (=**TN**) however uses the operating element (button), e.g, 80, indirectly to activate the available similarly located switches (located **N**orth, **S**outh, **E**ast, **W**est). In addition the operating element will directly activate a centrally installed switch (see references 14; 61,71), in addition to being stepwise rotatable. For the convenience of PCT/IPEA/SE we enclose sketches, Fig.1.2 illustrating the central switch operation, and Fig. 1.3 illustrating the rotary function.

In **D3** the switches are actived through use of twist-elastic "spring" elements in the cardan suspension.

In **TN** the activation of the N-S-E-W located switches is made through use of bending-elastic and torsion elastic "spring" elements, see attached sketch Fig. 1.5 In the activatyion there is a relative movement between the operating device and the central hole, e.g. 57, through the cardan unit (see sketches Figs. 1.1 and 1.4).

The operating element of **TN** has an independent mounting in said central hole 57, contrary to the case of **D3**.

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Structural differences between TN and D3:

D3 discloses that the activating arms legs 108, 110, 112, 114 are located in the operating element itself, whereas such legs are not present on the operating element of **TN**, as **TN** discloses the activating arms or projections , e.g. 9 – 9''' ; 66 – 69 to be on the inner part of the cardan unit.

D3 discloses the operating element to be permanent connectected to the central ring ogf the cardan unit through a pressure fit (a "glued" connection).

TN discloses an operating element which is freely , i.e. movably, attached to the to the cardan unit, which implies that is stepwise rotatable relative to the cardan unit, and also depressable relative to the cardan unit to activate the central switch through use of the central shaft 81. See sketches Figs. 1.2 and 1.3. Further, the operating element at selected rotary position thereof relative to the cardan unit is tiltable to actuate a selected one of the arms 9-9''' ; 66 – 69.

Operational loading differences:

Although **D3** discloses a cardan unit which appears similar to **TN**, the forces involved on the susopensions in the cardan unit are quite different. In **TN** the cardan unit suspensions are exposed to forces which are quite different from those of **D3**. In **TN** the cardan suspension receives a reactive force from the switch element S2 (as shown on the sketch) or in reality any of the N-S-E-W switches as recited above. This is made possible through the fact that in **TN** the activating arm is directly connected to the central ring of the cardan unit (through which the shaft 81 extends, the shaft also being movable up and down in a process of interaction with the central switch , in the attached sketches denoted as S1. Further highlighting is seen from the attached sketches.

In **TN** the bending-eleastic element also acts to provide overloading protection as illustrated on sketch Fig. 1.4 and protects the cardan unit against overloading. However, in view of not disclosed in detail in the specification, such feature is not in the claims.

Enclosed Sketches

The simplified sketches which are enclosed are for the convenience of PCT/IPEA/SE in order to more swiftly appreciate the entirely different operational differences of **TN** relative to **D3**. The sketches are not to be part of the PCT- application, but are merely provided for convenience to avoid a lengthy explanation. All elements shown on the sketches are also present on the drawings as originally filed, however drawn in a somewhat different way.

Sketch Fig.2 illustrates how forces on contact elements (for sensing rotational position of operating element) are independent of the the angle of the operating element, and sketch Fig. 3 illustrates how stepwise movement is provided and through use of a spring momentum equilibrium.

In Sketch Fig. 2 it is illustrated how a stable contact force is provided, irrespective of available tilting angle of the operating element. The ring shaped contact is in principle designed as a tensioned cross connected with a ring. In such a cross, the contact points constitute the one axis and the suspension of the contacts makes the other, but shifted 90° relative to the first

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axis. The condition for obtaining stable contact force is the election of independent suspension relative to the operating device. In a comparison, the slip contact can be comared with that part i a horizontal cardan unit which is located as the mid part, but in this context used for contacting purposes,

It should be observed that upon activation of the side located switches at N-S-E-W locations, the operating element of **TN** can be tilted freely without effects from the slip-contact tensioning. This is of advantage as a fixedly tensioned slip-contact would otherwise have influenced tactile feedback. As the "spring" elements of the cardan unit already have some effect on the force characteristics provided by the snap discs associated with the switches, this is of importance.

Summary

It is respectfully submitted that the claims as now presented have novelty over the closest prior art (D3), exhibit inventive step, and are related to an industrially applicable invention (a device according to the invention is now manufactured).

For TELENOSTRA AS et al

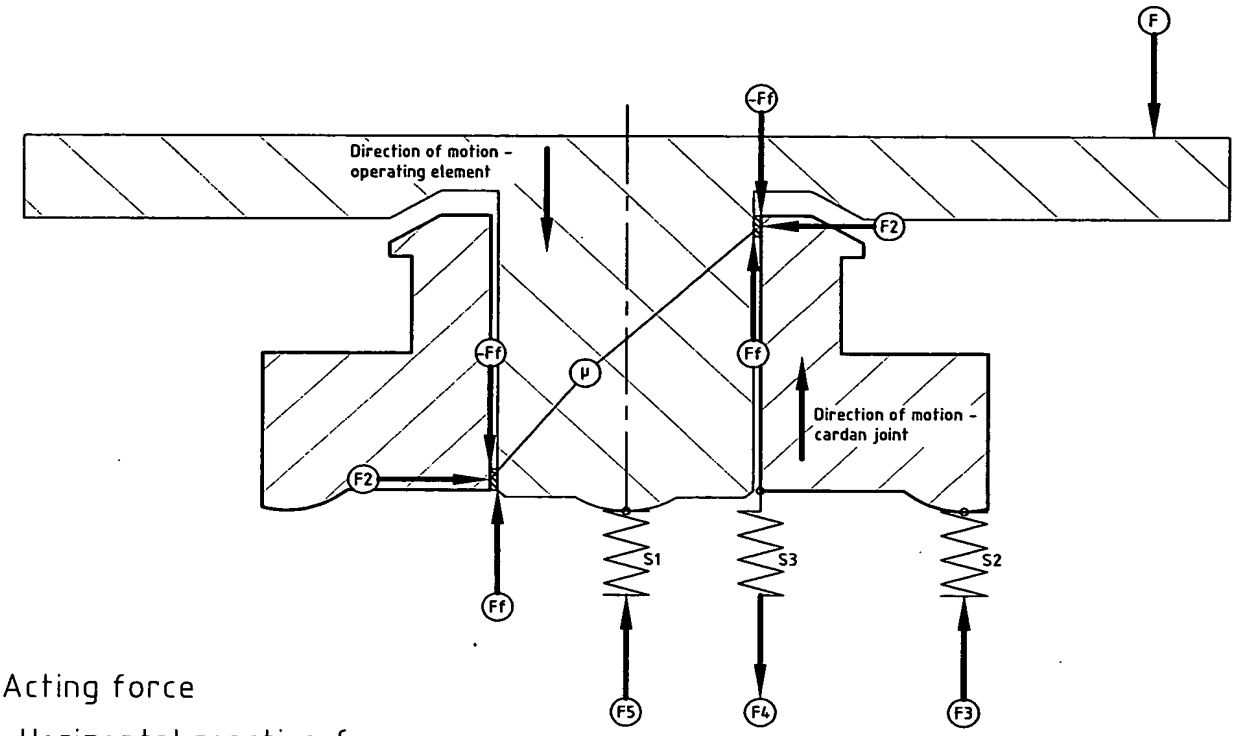
ZACCO NORWAY A/S

Jens F. C. Langfeldt (senior advisor)

Enclosures:

Amended claims 1 – 18
Sketches (7 sheets)

OPERATION OF SIDE PRESS POINT - RELATIVE MOTION



F = Acting force

F2 = Horizontal reaction force

F3 = Reaction force from spring element S2

F4 = Reaction force from spring element S3

F5 = Reaction force from spring element S1

Ff = Friction force acting to operating element

-Ff = Friction force acting to cardan joint

μ = Friction coefficient

S1 = Force characteristic from switch / tactile feel element - center position

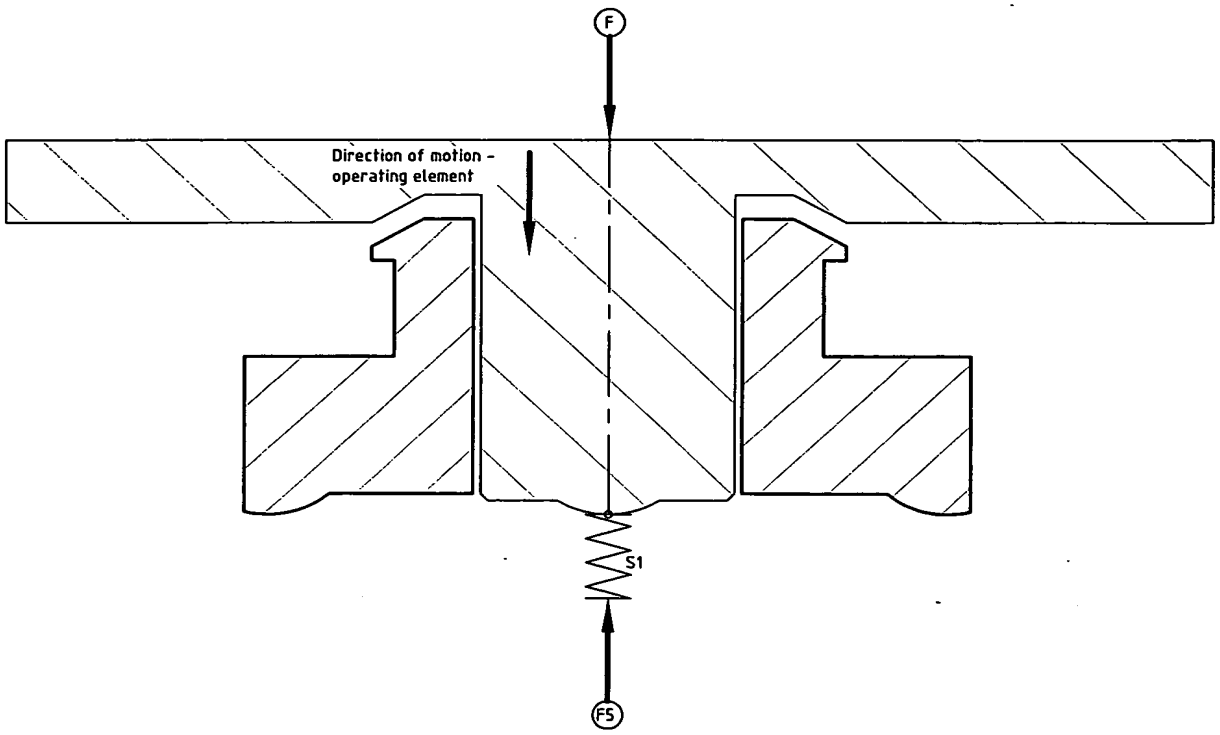
S2 = Force characteristic from switch / tactile feel element - side position

S3 = Force characteristic from bending elastic elements in cardan joint

Relative motion between operating element and cardan joint appears when:
$F3 > \Sigma(Ff)$ assumed that: $F > \Sigma(Ff)$.

Fig. 1.1

OPERATION OF CENTER PRESS POINT - RELATIVE MOTION



F = Acting force

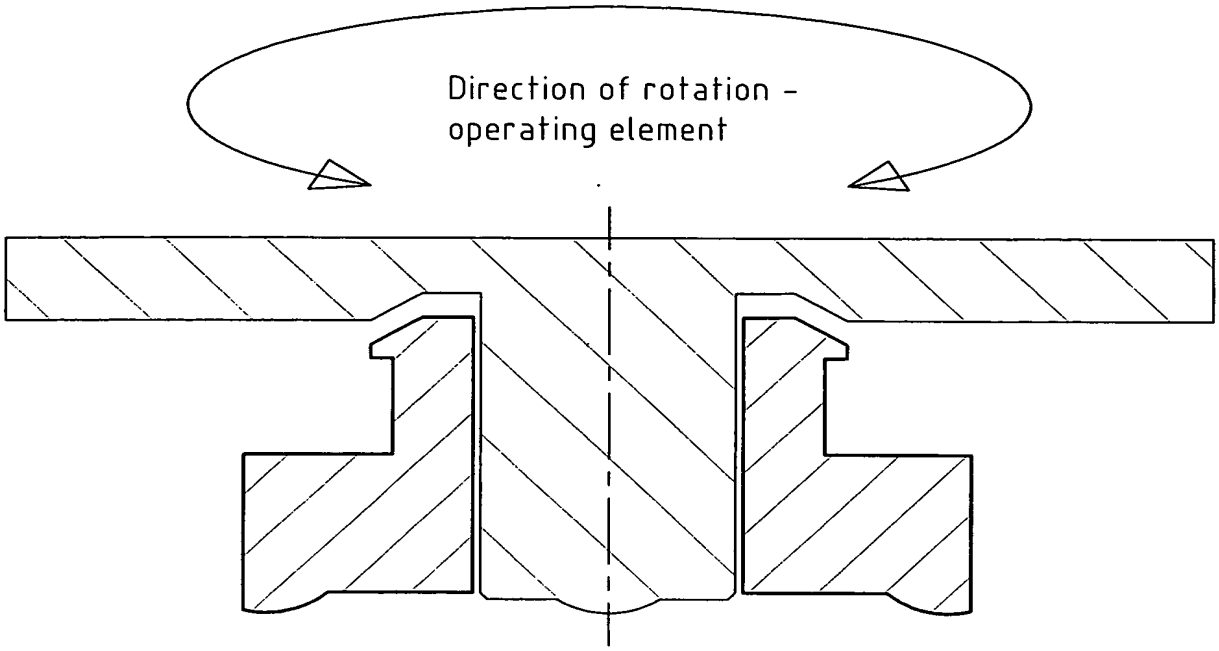
S1 = Force characteristic from switch / tactile feel element - center position

F5 = Reaction force from spring element S1

Relative motion between operating element and cardan joint appears when:
F > F5

Fig. 1.2

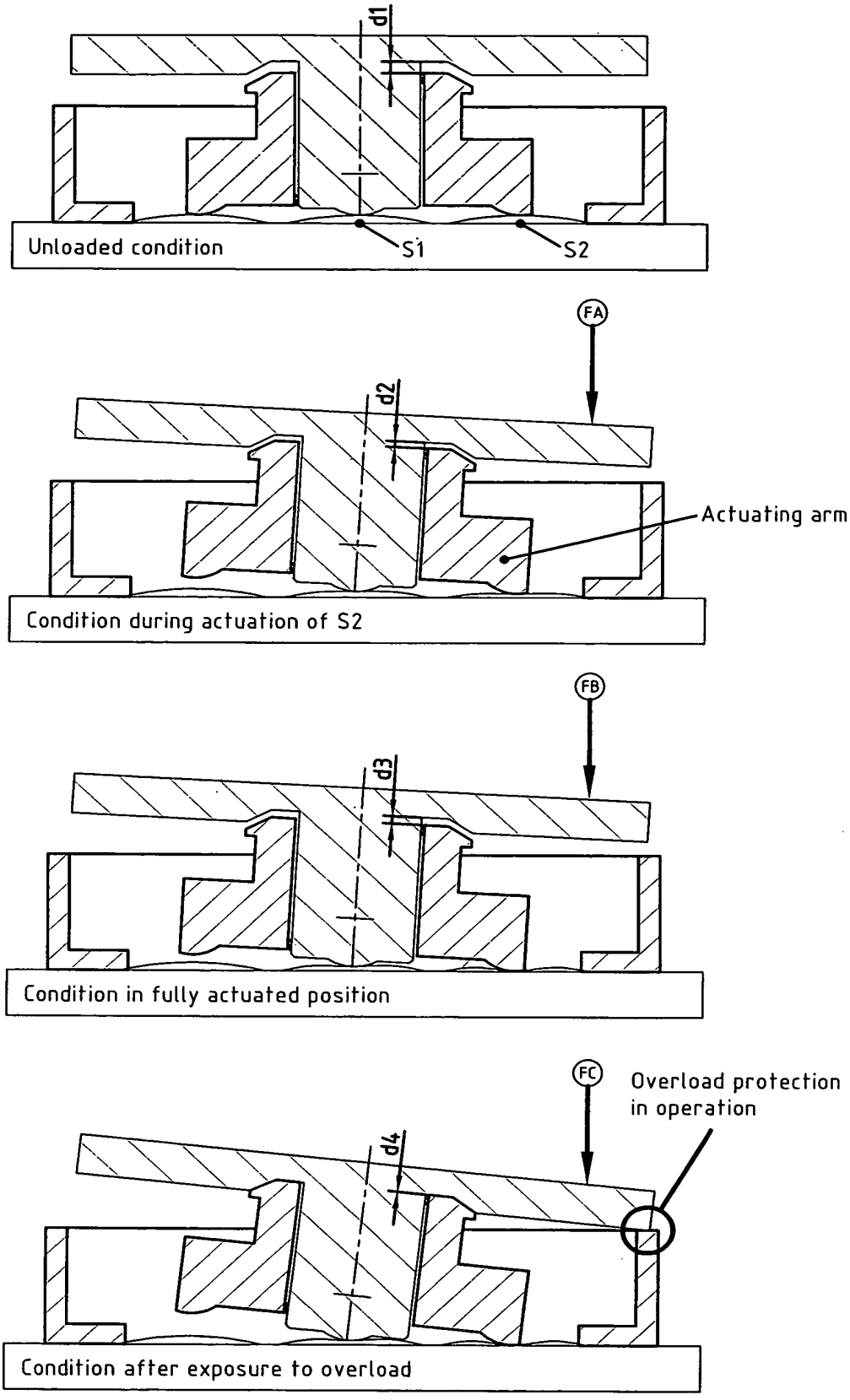
OPERATION OF ROTATION - RELATIVE MOTION



Relative motion between operating element and cardan joint during rotation operation.

Fig. 1.3

OPERATION OF SIDE PRESS POINT - RELATIVE MOTION - STEP BY STEP DESCRIPTION

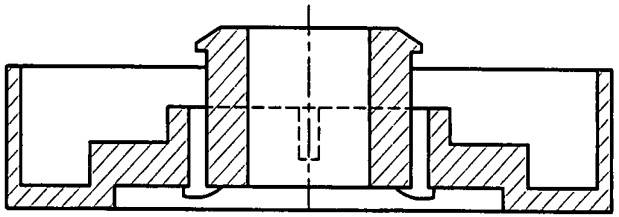


S1 = Switch / tactile feel element - center position
S2 = Switch / tactile feel element - side position
F.. = acting force
FA < FB < FC
d1 > d3 > d2 > d4

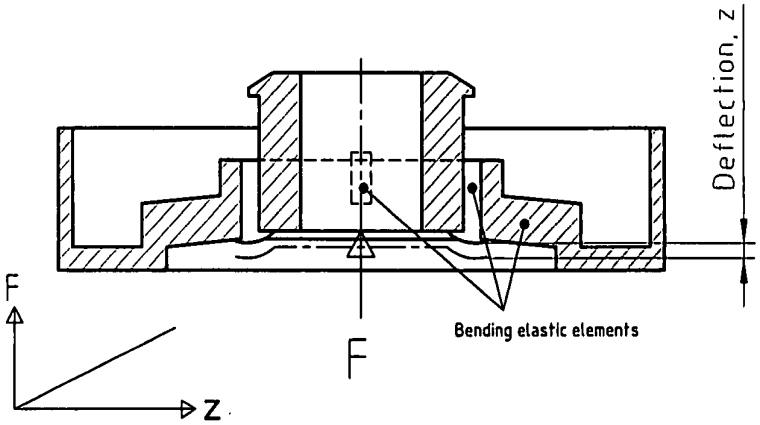
Fig. 1.4

LOAD CASES

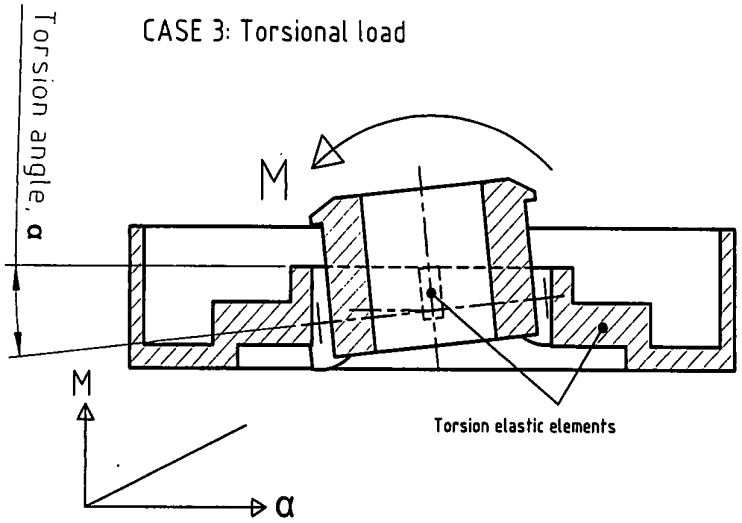
CASE1: Unloaded



CASE 2: Bending load



CASE 3: Torsional load



CASE 4: Load in application,
combination of bending and torsional load

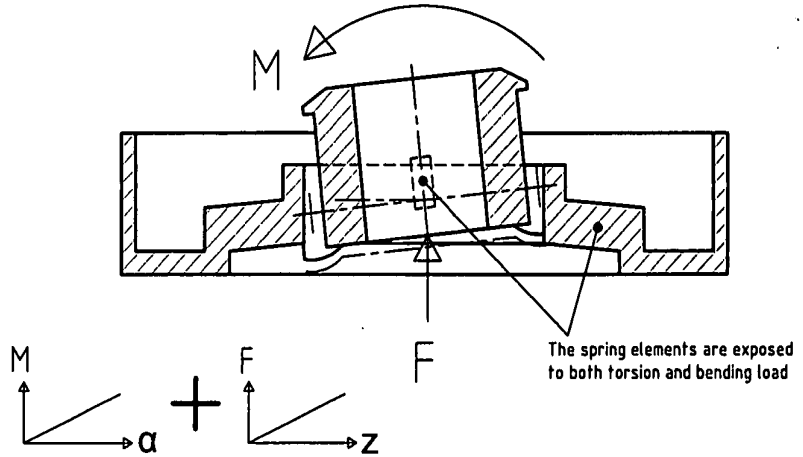
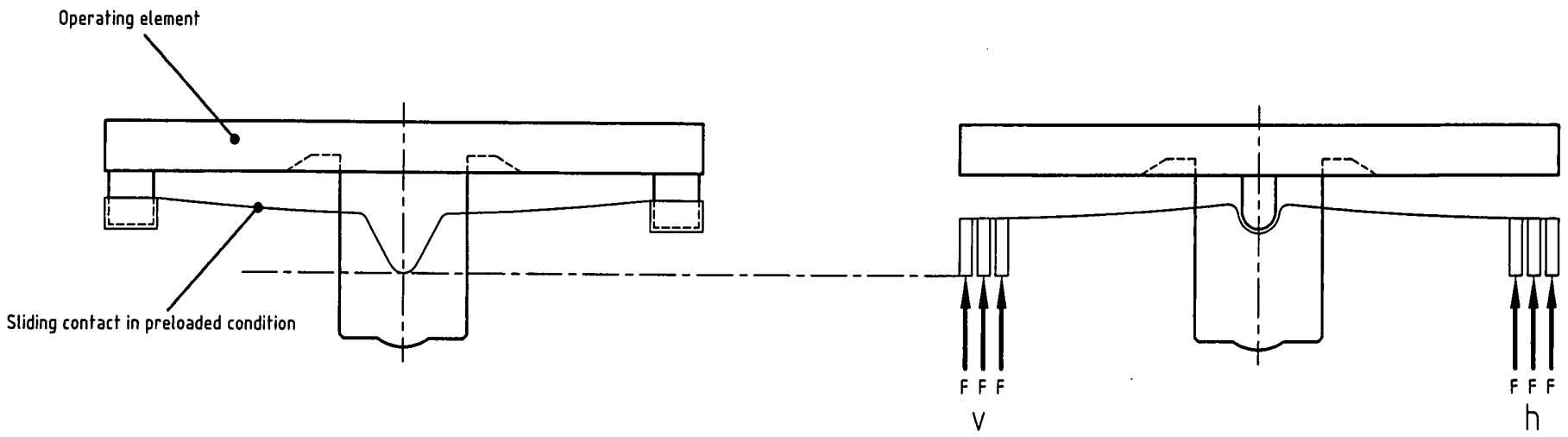


Fig: 1.5

EQUALIZATION OF CONTACT FORCE



The contact force is being equalized due to the independent supporting points

F = contact force

v = left side

h = right side

k = constant

$\Sigma(Fv) = \Sigma(Fh) = k$, independent of angular position of operating element

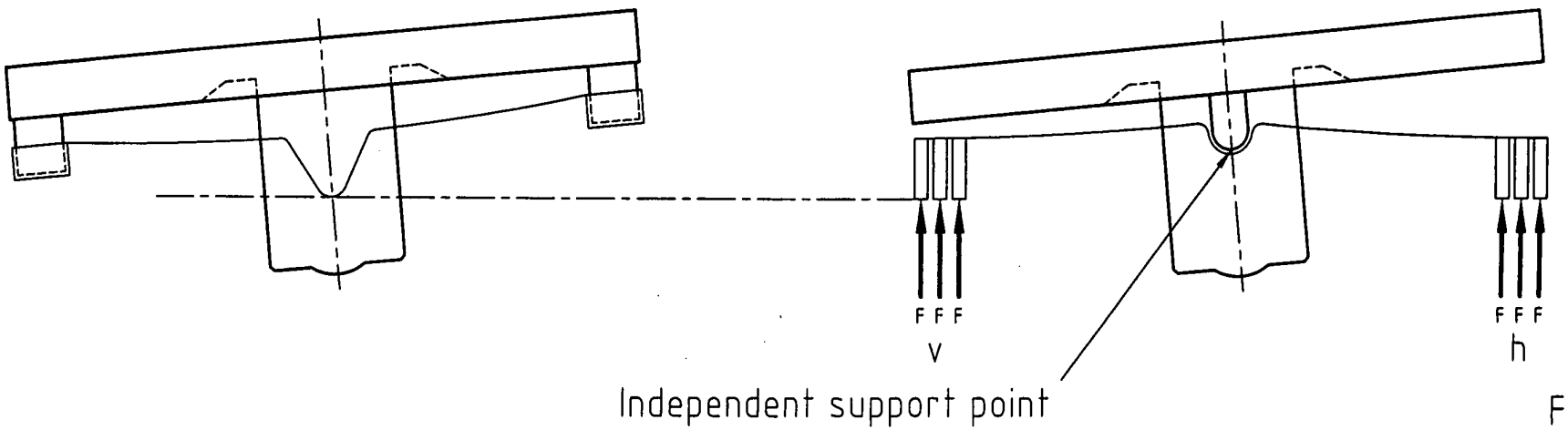
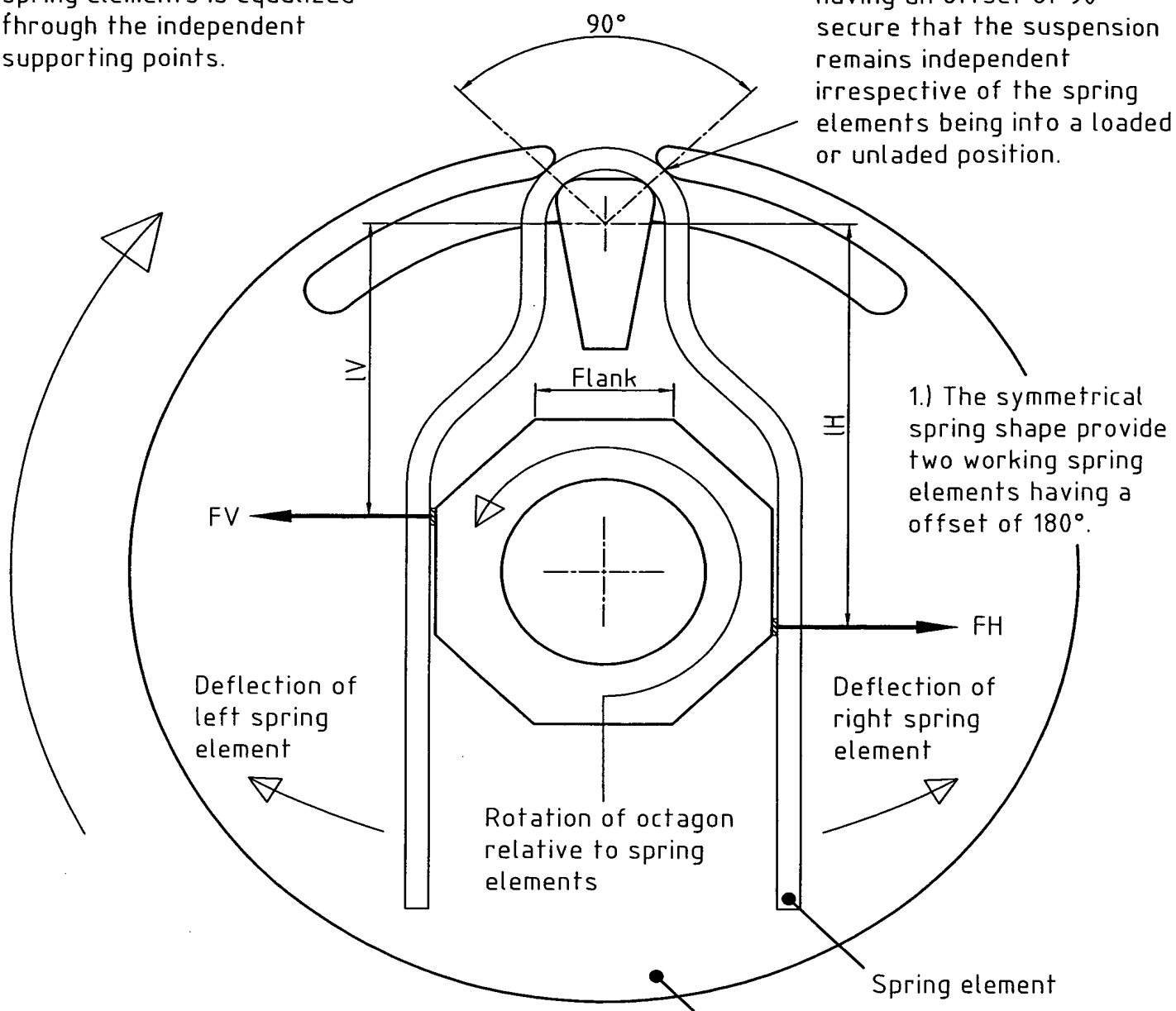


Fig. 2

SPRING EQUALIZATION EFFECT

2.) The spring force from the spring elements is equalized through the independent supporting points.

3.) Two supporting points having an offset of 90° secure that the suspension remains independent irrespective of the spring elements being into a loaded or unladed position.



1.) The symmetrical spring shape provide two working spring elements having a offset of 180°.

FV = Reaction force - left spring element

FH = Reaction force - right spring element

lV = Effective length - left spring element

lH = Effective length - right spring element

The spring is always kept into position by the equalizing torque:
Fv × lv = Fh × lh

Fig. 3

Amended Patent claims

1.

A multifunctional switch device having tilt functions, intended for use in electronic equipment such as computers, handheld electronic apparatus and/or devices associated with use in means of transport such as vehicles, boats and aircraft, said equipment having or being connected to a display for function control, the switch device having a central tilting device consisting of a housing which surrounds two mutually movable, cardan coupling-supported parts, a first of the parts mounted to the housing or to a base part of the device at a first pair of supporting points, and a second of the parts supported on the first part at a second pair of supporting points which are offset 90° relative to the first pair, characterized in

- that the switch device has an operating member or element which is stepwise rotatable relative to the housing with means to detect stepwise position of the operating member,
- that the operating member is tiltable as well as downward pressable,
- that the second part of the tilting device has arms in a cross shape that are configured to actuate underlying switch contact points upon tilting of the operating element, and
- that the second part has a hole in the centre for slidably receiving a shaft located on the operating member, said member forming a rotatable, tiltable and depressible part of the switch, said shaft operative as an actuator for a centrally underlying switch contact point.

2.

A multifunctional switch device as disclosed in claim 1,
characterised in

- that the housing, being in the shape of a ring, as well as said first part and said second part are fixedly attached to each other to form a one-piece unit, the supporting points being flexible and torsional for mutual cardan movement.

3.

A multifunctional switch device as disclosed in claim 1,
characterised in

- that the first of the two mutually movable, cardan coupling-supported parts is mounted to a switch base at a first pair of supporting points; and that second of said parts is supported on the first part at a second pair of supporting points which are offset 90° relative to the first pair, said first and second parts forming a one-piece unit.

4.

A multifunctional switch device as disclosed in claim 1, 2 or 3 ,

characterised in

- that the mutually movable parts of the tilting device are made of a flexible material.

5. 5.

A multifunctional switch device as disclosed in claim 1, 2 or 3 ,

characterised in

- that the two mutually movable parts of the tilting device are mounted on supporting points via shafts partly rotatable therein.

6.

A multifunctional switch device as disclosed in anyone of claims 1 -5,

characterised in

- that a centre portion of the tilting device which forms a mount for the rotatable shaft of the operating element has a plurality of vertical faces and/ or grooves, against which at least one spring of the switch device rides in order to effect stepwise rotation of the operating element.

7.

A multifunctional switch device as disclosed in claim 6, characterised in

- that the stepwise rotation is detected by means of contact springs which tilt on contact with grooves in the rotary element, and form contact with and/or short circuit at associated contact points arranged on the frame of the switch device.

8.

A multifunctional switch device as disclosed in anyone of claims 1 - 7, characterised in

- that the first part of the tilting device is fixedly attached to the second part via a second pair of supporting points, wherein the supporting points are flexible and torsional.

9.

A multifunctional switch device as disclosed in claim 8,

characterised in

- that the first part of the tilting device has a pair of projecting tilt pins for pivotal engagement with the first pair of supporting points.

10.

A multifunctional switch device as disclosed in anyone of claims 1 - 9,
characterised in

- that the first part of the tilting device has a pair of supporting points which are fixedly attached to the base and a frame, wherein the supporting points are flexible and torsional.

11.

A multifunctional switch device as disclosed in claim 6,
characterised in

- that spring is fastened to a rotatable operating member of the switch device.

12.

A multifunctional switch as disclosed in claim 11,
characterised in

- that the spring is of the wire type and is in the form of a clip.

13.

A multifunctional switch device as disclosed in anyone of claims 1 - 12,
characterised in

- that the rotatable operating member which is pivotally supported in the tilting device has mounted thereon an annular slip ring for sensing against contact fields located on a frame part of the device for detection of a rotary position of the operating in relation to the base of the device.

14.

A multifunctional switch as disclosed in claim 13,
characterised in

- that said annular slip ring has two diagonally located points for attachment to the operating member and two diagonally located pins for contacting the contact fields.

15.

A multifunctional switch device as disclosed in one or more of claims 1 - 14,
characterised in

- that the base of the switch device has a plurality of snap discs and associated plurality of contact fields to provide for respective switch functions upon tilting or depression of the operating member; and

- that the base has mounted thereon an outer frame internally of which is located in a ring configuration a plurality of contact fields which contact points on the slip ring touch for detection of rotary position of the operating member relative to the device base.

16.

A multifunctional switch device as disclosed in anyone of claims 1 - 15,
characterised in

- that central depression of the operating member and its shaft part is designed to cause collapse of an underlying snap disc on a central contact field , whilst pressure on an outer part of the operating member or tilting of the operating member is designed to provide a movement of the tilting device which causes, through interaction with one of the arms on the tilting device, a collapse of one of the outer snap discs on an associated contact field underlying said arm.

17.

A multifunctional switch device as disclosed in one or more of claims 1-16,
characterised in

- that the operating member has an outer face, or is encased by a part made having an outer face which is smooth or has contours, dimples or structures for friction against a user's finger in the peripheral area; and
- that the outer face is concave in a central part thereof and with a tactile pin or depression is arranged in the centre.

18.

A multifunctional switch device as disclosed in anyone of claims 1 – 17,
characterised in

- that the operating member is centrally depressible, stepwise rotable, as well as tiltable in four directions in order to actuate respective switch functions associated with such available movements of the switch device.